View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Digital Repository @ Iowa State University

IOWA STATE UNIVERSITY
Digital Repository

Integrated Crop Management News | Agriculture and Natural Resources

3-17-2003

Integrating conservation tillage and manure management to improve water quality

Mahdi Al-Kaisi
Iowa State University, malkaisi@iastate.edu

Mark Licht
Iowa State University, lichtma@iastate.edu

David Kwaw-Mensah
Iowa State University, dkwaw@iastate.edu

H. Mark Hanna
Iowa State University, hmhanna@iastate.edu

Michael Tidman
Iowa State University

Follow this and additional works at: http://lib.dr.iastate.edu/cropnews


Part of the Agricultural Science Commons, Agriculture Commons, Agronomy and Crop Sciences Commons, and the Bioresource and Agricultural Engineering Commons

Recommended Citation
Al-Kaisi, Mahdi; Licht, Mark; Kwaw-Mensah, David; Hanna, H. Mark; and Tidman, Michael, "Integrating conservation tillage and manure management to improve water quality" (2003). *Integrated Crop Management News*. Paper 1697.
http://lib.dr.iastate.edu/cropnews/1697

This Article is brought to you for free and open access by the Agriculture and Natural Resources at Digital Repository @ Iowa State University. It has been accepted for inclusion in Integrated Crop Management News by an authorized administrator of Digital Repository @ Iowa State University. For more information, please contact digirep@iastate.edu.

Integrating conservation tillage and manure management to improve water quality

Water quality, conservation tillage, and nutrient and manure management are closely linked. The recent update of impaired water bodies by the Iowa Department of Natural Resources lists 188 stream and river segments, lakes, and impoundments. In Iowa, tillage, nutrient management, and manure management play substantial roles in affecting both surface and groundwater quality.

A tillage survey sponsored by the Iowa Resource Management Partnership (IRMP) indicated that there is a need for Iowa producers to accelerate their adoption of conservation tillage practices. To improve Iowa's water quality, soil erosion control and residue management, along with nutrient and manure management, have to become high priorities for every producer.

Adopting best management practices throughout an operation includes taking both manure application and tillage management into consideration. Even though the IRMP survey indicated that strip-till, ridge-till, and minimum tillage are effective alternatives to conventional tillage, especially for corn production, producers still associate no-till with colder, wetter soil and lower yields. The survey also showed that producers would like to have their concerns addressed to help them adopt conservation tillage practices.

Liquid manure application with a narrow knife in soybean residue.

Enlarge [1]

Furthermore, the manure injection equipment typically used by most Iowa producers may reduce residue levels so that erosion becomes a problem, no matter what tillage management system is being used. Thus, even though manure application is not ordinarily considered a tillage operation, it may be acting as one, leaving producers with soil that is vulnerable to water erosion. Therefore, an integrated approach for adopting best management practices for manure application, nutrient management, tillage, and crop residue management is essential for producer operations to be truly effective in reducing soil erosion. Alternative tillage systems such as strip-till, or manure injection as a tillage alternative, could resolve some of the limitations currently associated with no-till.

"Hub and Spokes" Project demonstrates how integration could work. In cooperation with Northeast Iowa Agricultural Experimental Association and Iowa State University

Extension researchers, field demonstrations were conducted in more than a dozen counties in northeastern and central Iowa in 2002. This network of livestock producers, commercial manure applicators, and crop producers was developed to conduct replicated trials in participant producer operations, in conjunction with research efforts conducted at the Northeast Research Farm. A hub and spokes participatory model was used as a foundation for education and outreach programming. The project is funded through the Integrated Farm and Livestock Management Program sponsored by the Iowa Department of Agriculture. Preliminary results are presented here.

Figure 1 shows the relationship between yield and nitrogen (N) rates as liquid manure and anhydrous (NH3-N) under different tillage systems. Different tillage systems had no significant effect on yield for all N rates (except where low N rates were used). In general, yields associated with N rates beyond 75-90 lb N/acre showed no significant differences in yield response, regardless of the tillage system. This research suggests that the manure and nutrient management history associated with the sites has an effect on site response to N application. Also, the lack of response to additional N indicates that, under these conditions, corn yields can be maintained, even at a lower N rate.

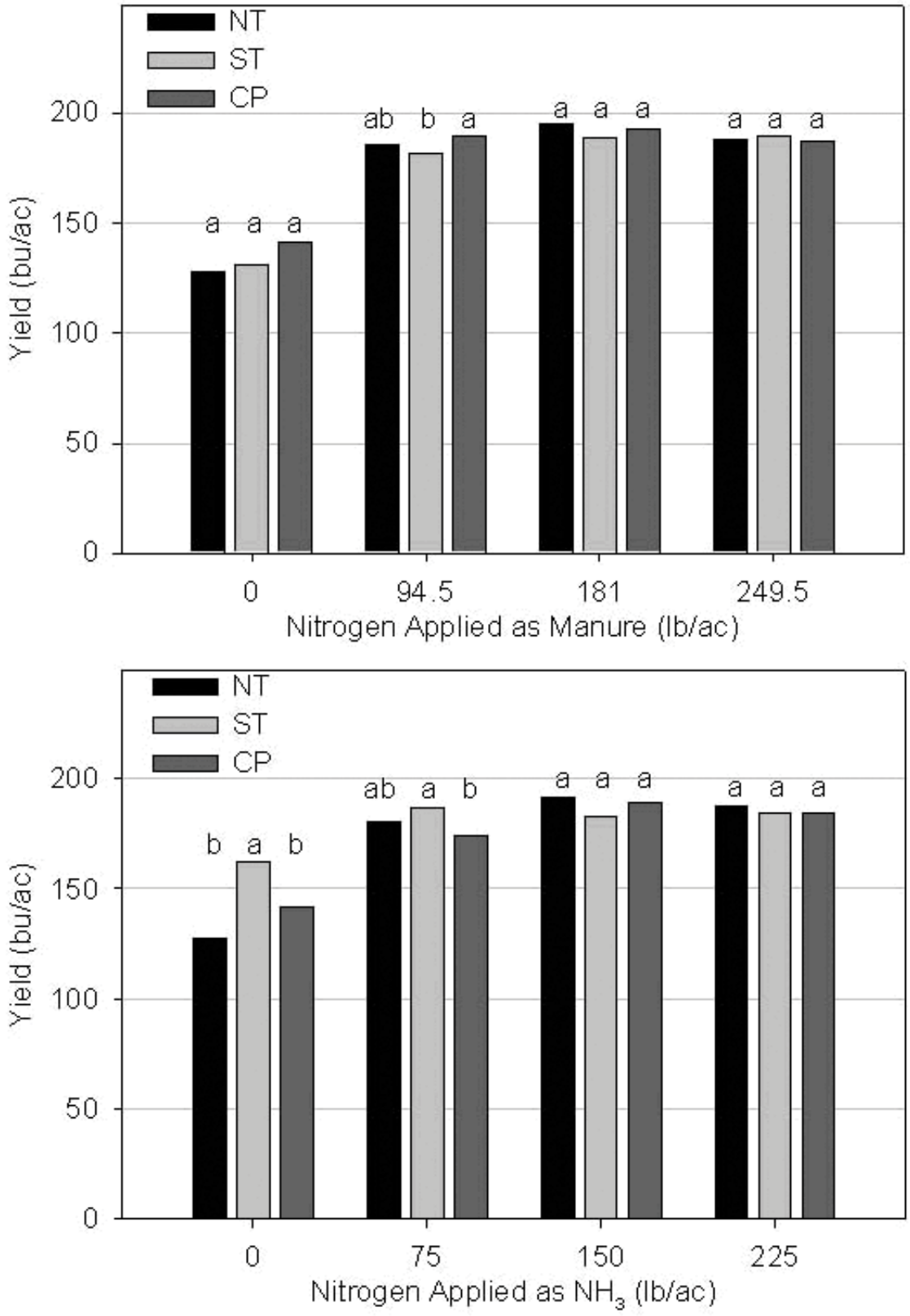

Figure 1. *Corn yield under different tillage systems and N rates for both manure and commercial N sources. NT, no-till; ST, strip-till; CP, Chisel plow.*

Another N status indicator that can be used in N management is the fall stalk nitrate (NO_3) test. The fall stalk NO_3 test evaluates the status of N in the corn stalk at physiological maturity. Figure 2 indicates that the NO_3 concentration in stalks where manure N was applied

was greater than the NO_3 concentration with commercial N fertilizer, probably due to much higher N rates in the liquid manure application compared with that of the commercial N application. Therefore, fall stalk NO_3 concentration under manure treatment was much higher than that with commercial N, regardless of the tillage system.

The ranges for stalk NO_3 concentrations shown in Figure 2 are the limits of NO_3 concentration suggested for yield response and N concentrations as stated in Iowa State University Extension publication PM 1584, Corn Stalk Test to Determine Nitrogen [2]. The stalk NO_3 concentration limits indicate the probability of yield response to N application, and where the probability of additional yield response to additional N application decreases, the range of stalk NO_3 increases.

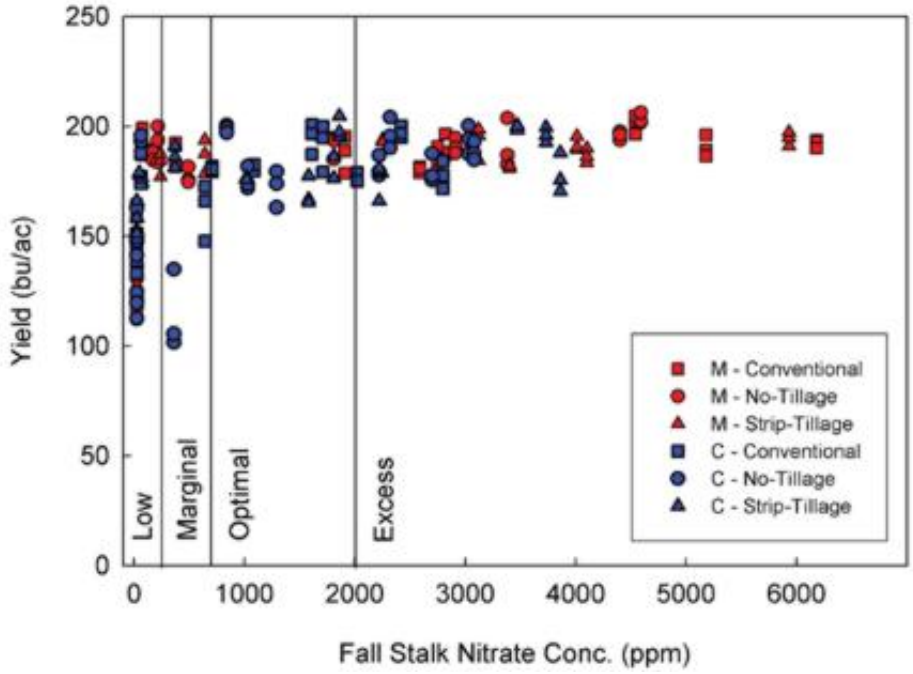

Figure 2. *Corn yield versus fall stalk NO_3 concentration for both manure and commercial N sources under three different tillage systems.*

The additional NO_3 accumulation in the stalk beyond 2,000 ppm is termed "luxury N use," and it does not contribute to any yield increase. The high values of the stalk NO_3 concentration associated with manure application were due to lack of accurate manure application rates, in addition to the field's manure history. Controlling rates of manure application is one of the challenges that producers face, but it can be corrected with calibration of manure applicators.

Conclusions

Producers can combine manure application with strip-till and no-till management systems, with no effect on yield. To reverse the declining trend in water quality in Iowa, producers should look more closely at doing so. Producers can use the stalk NO_3 test and early spring soil NO_3 test to adjust their N rates for next season.

This article originally appeared on pages 15-16 of the IC-490 (3) -- March 17, 2003 issue.

Source URL:
http://www.ipm.iastate.edu/ipm/icm//ipm/icm/2003/3-17-2003/integration.html

Links:
[1] http://www.ent.iastate.edu/imagegal/practices/manure/manure_knife_soy.html
[2] http://www.extension.iastate.edu/Publications/PM1584.pdf

IOWA STATE UNIVERSITY
University Extension